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## New algorithms for real-time, 24 hr continuous and noise-adjusted power spectral analysis of heart rate and blood pressure fluctuations in conscious rats.

Nagai R, Nagata S

Department of Pharmacology I, Dainippon Pharmaceutical Co., Ltd., Osaka, Japan.

The effective combination of C+2 and assembler could realize real-time power spectral analysis of various fluctuation indexes simultaneously. The blood pressure (BP) waveform indexes (WIs) analyzed simultaneously were heart rate (HR), systolic blood pressure (SBP), mean blood pressure (MBP) and diastolic blood pressure (DBP). Power amplitudes (very low frequency, VLFamp; low frequency, LFamp; and high frequency, HFamp) were evaluated by accurate BP waveform recognition, accurate automatic rejection of outliers, baseline adjustment in periodograms and digital filtering of each amplitude. In the in vivo experiments, the amplitudes were changed in a dose-dependent manner by methylatropine (HR-VLFamp, HR-LFamp and HR-HFamp), phentolamine (HR-LFamp, SBP-VLFamp, SBP-LFamp and SBP-HFamp) and propranolol (HR-LFamp and SBP-LFamp). The absolute correlation coefficients of the amplitude and the change in each parameter were more than 0.96. In conclusion, this real-time, noise-adjusted power spectral analysis system for investigating HR and BP fluctuations enabled us to accurately evaluate autonomic nerve activity in conscious rats. Moreover, unlike other systems, this system was able to detect the biphasic changes in SBP-HFamps caused by phentolamine.

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## Assessment of autonomic nervous function by power spectral analysis of heart rate variability in the horse.

Kuwahara M, Hashimoto S, Ishii K, Yagi Y, Hada T, Hiraga A, Kai M, Kubo K, Oki H, Tsubone H, Sugano S

Department of Comparative Pathophysiology, Graduate School of Agriculture and Life Sciences, University of Tokyo, Japan.

We studied power spectral analysis of heart rate (HR) variability in the horse, with the hypothesis that the quantitative information provided by the spectral analysis of HR variability reflects the interaction between sympathetic and parasympathetic regulatory activities. For this purpose, electrocardiogram, blood pressure (BP) and respiratory (Resp) waveform were simultaneously recorded from Thoroughbred horses (3-5 years old) and analyzed by power spectrum. There were two major spectral components at low-frequency (LF) and high-frequency (HF) bands for HR variability. The peak of Resp variability clearly occurred at the HF range. In contrast to Resp variability, the power spectra of BP variability occurred at lower frequencies. The maximum coherence between HR and Resp variabilities and HR and BP variabilities occurred at approximately 0.15 and approximately 0.03 Hz, respectively. These relationships were similar to the ensemble spectra. On the basis of these data, we have defined two frequency bands of interest: LF (0.01-0.07 Hz) and HF (0.07-0.6 Hz). Therefore, we believe that power spectral analysis of HR variability provides a very powerful technique for assessing autonomic nervous activity in the horse.

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